

fractional powers; in the algebraic theory it is almost impossible to avoid this, except by tedious divagations, but in the theory of numbers such symbols ought to be avoided if possible, and their occurrence here may cause some readers a shade of regret. G. B. M.

LISSAJOUS'S FIGURES.

Harmonic Vibrations and Vibration Figures. By J. Goold, C. E. Benham, R. Kerr, and Prof. L. R. Wilberforce. Edited by H. C. Newton. (London: Newton and Co., n.d.) Price 6s. net.

THE four authors of this book have each contributed an account of the construction and use of apparatus which they have invented or brought to perfection, the several parts of the book being independent of one another, but related by the similarity of the subject-matter. Lissajous's figures were originally introduced as a convenient method of illustrating optically or mechanically acoustic phenomena, but the beauty and perfection of the results obtained by the compound pendulum of Tisley, and later by the twin elliptic pendulum of Goold, have made the subject sufficiently attractive to be pursued for its own sake. As two leading scientific publishers declined to take the book on the ground that it could not pay, we are indebted to Messrs. Newton and Co. for rescuing and producing a book which will be valued in many quarters.

Mr. Benham writes the history of the harmonograph; and describes his own triple pendulum and his own modification of Goold's twin elliptic pendulum. He also gives valuable information to anyone who would construct his apparatus as to the details which are necessary for success. The construction of the ruling pen, choice of inks or dyes, the selection of suitable paper, interesting dodges with photographic plates or with successive chemicals, are a few only of the tips or dodges described. The extremely beautiful stereoscopic effects obtained by viewing two nearly identical harmonograph figures with a stereoscope are described and illustrated, as is the curious change which occurs when such a pair of figures are slowly turned round at the same time, so as to change their relative aspect, the series of lines all appearing on the surface of a cylinder in the one position, and gradually merging into a series, each of which lies between the last one and the axis in the other position. In the case of figures drawn by the twin elliptic pendulum, where it would be next to impossible to draw two successive figures which should be sufficiently alike, the ingenious plan is adopted of selecting those which have a two-fold symmetry, but in which the two halves on opposite sides of the centre are not quite identical, and then simply turning one upside down, in order to obtain stereoscopic shell-like structures of wonderful beauty. Several examples of the marvellous beauty of the twin elliptic pendulum's work are given, in which it is difficult to know whether the forms of the curves or the water-mark patterns are the more to be admired.

Visitors at soirées of the Royal Society will remember the curves drawn by Mr. Goold's big twin elliptic pendulum, as also that queer vibrating and droning

steel plate, which gave rise to so many curious phenomena. One passage from Mr. Goold's description may here be quoted.

"If . . . a small chain be thrown on the vibrating plate, it will immediately settle itself on the curved line between the vortices and . . . will crawl away to the nearest vortex, and there coil itself up like a serpent, continuing to rotate as long as the plate remains sufficiently excited."

This is one only of a number of curious results obtained by Mr. Goold.

Mr. Richard Kerr describes a form of geometric pen, capable of producing very beautiful patterns. This is followed by an account of Mr. Lewis Wright's method of projecting Lissajous's figures on a screen, using reeds in the place of tuning forks, and Prof. Wilberforce describes his well-known sympathetic vibrations obtained by the aid of one or two torsion springs.

This is an excellent book for the Christmas holidays.
C. V. Boys.

OUR BOOK SHELF.

Cattle of Southern India. By Lieut.-Col. W. D. Gunn. Department of Agriculture, Vol. III., Bulletin No. 60. Pp. 65; plates. (Madras: 1909.) Price 3s.

ALTHOUGH the existence of a number of local breeds and sub-breeds of Indian humped cattle (*Bos indicus*) is familiar to Anglo-Indians, comparatively little is known about them in this country, and it is, therefore, highly satisfactory that Col. Gunn, Superintendent of the Indian Civil Veterinary Department at Madras, has furnished us with this elaborately illustrated account of the various types to be met with in southern India. It is, however, a matter for regret that the author did not see his way to make his work complete by including the breeds found in other parts of India. As to the origin of humped cattle, the author is silent, and perhaps wisely so, since, so far as we are aware, nothing definite has hitherto been ascertained with regard to this subject.

If we rightly understand him—and his classification is by no means so clear and unmistakable as it might be—the author considers that there are two main types of large-humped cattle in southern India, namely, the Mysore and the Ongole, or Nellore. The former, which are characterised by the long, more or less upwardly directed, slightly tapering horns, and generally iron-grey or bluish colour, are, however, divisible into a number of sub-breeds, such as the Amrat Mahal, Hallikar, Alumbadi, &c., all of which come under the native designation of Doddadana, or large cattle, in contradistinction to the Nadudana, or ordinary small village cattle. The finest of all are the cattle of the Amrat Mahal breed, which were formerly owned by Tippu Sultan, but became the property of the British Government after the fall of Seringapatam, although the management of the herds remained for a time under the control of the Maharaja of Mysore, on condition of his supplying a specified number of bullocks. In the old days of Indian warfare these cattle were of the greatest value for transport-purposes on account of their rapid pace.

The Nellore, or Ongole, cattle, on the other hand, carry short and somewhat stumpy horns, which are, however, longer in cows than in bulls, and have an outward and slightly backward direction. Formerly black-and-white was in fashion, but white is

now the favourite colour for these cattle, the ears of which droop more than in the Mysore type. Although probably less hardy than the Mysore breeds, these cattle are unsurpassed for slow work, a pair, it is stated, being capable of drawing a load of five tons.

The volume closes with a notice of the domesticated buffaloes of southern India, special mention being made of the Toda customs associated with the cult of these animals. R. L.

Flora of Cornwall. Being an Account of the Flowering Plants and Ferns found in the County of Cornwall, including the Scilly Isles. By F. H. Davey. Pp. lxxxviii+570. (Penryn: F. Cheg-widden, 1909.) Price 21s. net.

ON account of its extreme situation, the mildness of the climate, and the interesting rock formations, notably round the Lizard, the county of Cornwall exercises a great fascination for students interested in natural history. It is rather strange, therefore, that a county flora should only now be compiled, especially as many botanists—natives, aliens, and others—have found it a profitable hunting ground. Six years ago Mr. Davey published a preliminary list of plants which was deserving of the title of a flora, but this was only intended to form a basis for a more complete survey and to arouse interest in the undertaking; the intention has been entirely successful, and the author's subsequent labours, assisted by energetic and able co-workers, have culminated in the volume under notice, in which the total number of plants is computed at 1180; and of these, 953 are considered to be native.

The greater part of the book is devoted to the enumeration of species, with detailed list of localities for all but very common plants; in this matter the author has been over-bountiful, and space could have been saved by the elimination of the long list of localities for certain species that are in no sense critical, such as *Spiranthes autumnalis* or *Centranthus ruber*. The number of species found in Cornwall, but not recorded for any other county in Britain, amounts to twenty, while a comparison with Devonshire shows that fifty-three plants growing in Cornwall have not been collected in Devonshire, as against 103 confined to the latter county.

A considerable part of the introduction is given up to a history of botanists who have contributed to the county records, and a few photographs of notable local botanists are included; there is also a short account of eight botanical districts which are indicated on an accompanying map, and a list of a few plants peculiar to each, but the author has not attempted an ecological sketch of the chief formations. Among the Cornish botanists the best-known name is that of the Rev. C. A. Johns, the author of "Flowers of the Field" and "A Week at the Lizard," while William Curnow, T. R. Archer Briggs, and Richard Tellam were even more zealous field workers. Mr. Davey, too, has added his quota of records, for which he deserves to rank among the honoured list of local botanists, as also for the strenuous work in connection with this publication. The volume is worthy to rank with the standard county floras, more particularly in the verification of records and critical compilation.

The Elements of Animal Physiology. By Prof. W. A. Osborne. Pp. 152. (Melbourne: Thomas C. Lothian, 1909.)

THE size of this little book will indicate that it contains a mere sketch of the large subject of which it treats. It is written for the purpose of supplying non-medical readers with an introductory account of mammalian physiology, in the hope that they subse-

quently will take up the question more fully. Prof. Osborne has in Melbourne to teach students of agriculture and veterinary science, in addition to those who are taking full medical or science courses, and it is to the former class of students that the work is specially addressed. One can hardly doubt that agriculturists, especially in Australia, where the breeding of domestic animals forms such a large part of their work, will benefit greatly if they have a rational substratum of physiological facts at their disposal.

The book is trustworthy and free from errors; it is specially full on its biochemical side, which is what one would anticipate from Prof. Osborne's research work. Complex questions, such as those dealing with the nervous system, are treated with extreme brevity, and this is to be regarded as judicious, seeing what class of readers are specially catered for. We wish the book the success it deserves.

A Text-book of Experimental Physiology for Students of Medicine. By Dr. N. H. Alcock and Dr. F. O'B. Ellison. With a preface by Prof. E. H. Starling, F.R.S. Pp. xii+139. (London: J. and A. Churchill, 1909.) Price 5s. net.

TO some extent this little book is the outcome of a conference of the London teachers of physiology. They have for long felt that a revision of their practical courses was necessary, and the present work, which is issued under the ægis of Prof. Starling, indicates the kind of reform considered desirable. One understands that in the future the practical examinations in the University of London, at any rate, will be largely modelled on the kind of course here presented. The main underlying new idea is that medical students should be taught physiology so as to fit them for being, not expert pure physiologists, but medical men with a knowledge of those portions of the vast subject which will be immediately useful to them in their study and treatment of diseased conditions. The frog is therefore relegated to a position of subsidiary importance, and as many experiments as possible are given in which the mammal, and especially man himself, is the *corpus vile*. It would be ungracious at this stage to point out faults of omission and commission of which the authors, Drs. Alcock and Ellison, have been guilty in their praiseworthy attempt to carry out the new idea. It will only be possible to do so when the book has been tried as a practical guide, and future editions will no doubt, show various improvements, after the present one has been subjected to this test. W. D. H.

Elementary Photo-micrography. By Walter Bagshaw. Second edition. Pp. 103. (London: Iliffe and Sons, Ltd., 1909.) Price 2s. 6d. net.

THE object of this little book is to arouse interest in, and give instruction to, those to whom such a study would otherwise possibly appear far too abstruse and full of difficulty. It is most clearly and lucidly written, and there is an evident desire to avoid unnecessary detail. It would be easy to criticise and to point out the many omissions of essential detail that to an advanced worker are only too obvious; but it must be admitted that for the beginner and intelligent worker the instructions would prove, in the majority of cases, ample. Nearly the whole of the course of work suggested may be carried out with simple apparatus; in fact, it is much to the credit of the writer that simplicity, and the absence of any recommendation to use complex apparatus, is the keynote of the entire book. It is perhaps to be regretted that, having gone so far, he has not in some directions slightly extended the work. The instructions in the use of the microscope itself are perhaps unneces-